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THE NEED FOR IN-SCHOOL BUSINESS DATA PROCESSING PROGRAM.

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TWO STUDIES, CONDUCTED SIMULTANEOUSLY IN WAYNE, OAKLAND, AND MACOMB COUNTIES, MICHIGAN, TO DETERMINE THE CURRENT AND PROJECTED STATUS OF EMPLOYMENT IN DATA PROCESSING INSTALLATIONS AND THE NEED FOR IN-SCHOOL TRAINING PROGRAMS, WERE IDENTICAL EXCEPT THAT ONE USED PAID, PROFESSIONAL INTERVIEWERS, AND THE OTHER USED AMATEUR INTERVIEWERS TO COLLECT DATA IN 212 COMPANIES. SOME FINDINGS WERE--(1) AMATEUR INTERVIEWERS COLLECTED AS RELIABLE DATA AS PROFESSIONAL INTERVIEWERS, (2) THERE WERE AN ESTIMATED 424 DATA PROCESSING INSTALLATIONS WITH 10,740 EMPLOYEES OF WHICH 60 PERCENT WERE KEY PUNCH AND MACHINE OPERATORS, (3) AN ESTIMATED 3,578 ADDITIONAL PERSONNEL WERE TO BE HIRED IN 1965 AND 1966 AS REPLACEMENTS AND ADDITIONS IN EXISTING INSTALLATIONS, (4) APPROXIMATELY 67 PERCENT OF ALL DATA PROCESSING PERSONNEL HAD NO PREVIOUS TRAINING IN DATA PROCESSING AT THE TIME THEY WERE HIRED, AND (5) A HIGH SCHOOL EDUCATION IS SUFFICIENT FOR ENTRY INTO A DATA PROCESSING POSITION. IT WAS RECOMMENDED THAT ONE OR MORE MICHIGAN TEACHER TRAINING INSTITUTIONS BE ENCOURAGED TO PREPARE DATA PROCESSING TEACHERS, HIGH SCHOOLS BE ASSISTED THROUGH VOCATIONAL EDUCATION FUNDS TO PREPARE GRADUATES TO ENTER THESE EMERGING OCCUPATIONS, AND THIS STUDY BE REPLICATED ANNUALLY. THE INTERVIEW INSTRUMENTS AND STATISTICAL DATA FOR NUMBER OF INSTALLATIONS, PROJECTION OF EMPLOYMENT TRENDS, EDUCATIONAL REQUIREMENT BY JOB TITLES, AND RESPONDENT PREFERENCES FOR INSTITUTIONS PROVIDING TRAINING ARE INCLUDED. (PS)

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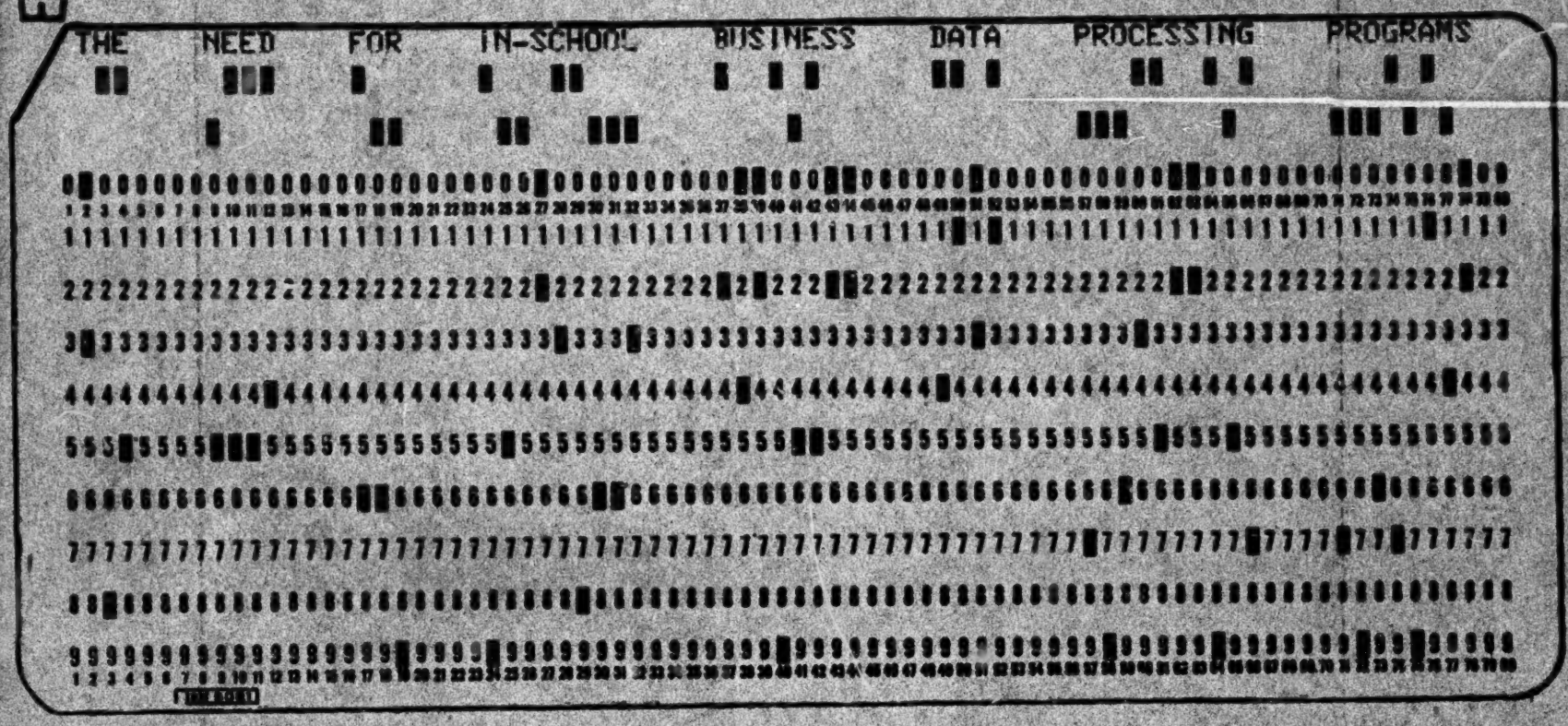

Dr. Fred S. Cook

prepared for

STATE OF MICHIGAN DEPARTMENT OF EDUCATION

WAYNE STATE UNIVERSITY
College of Education
Business and Distributive Education

June, 1966

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PREFACE

In October, 1963, Drs. Fred S. Cook and Eleanor Maliche, Department of Business and Distributive Education, Wayne State University, submitted a proposal to the Division of Vocational Education of the Michigan Department of Education for funding. The proposal was funded in January, 1964, and interviewing began in September, 1964.

In the preliminary stages--development of the instrument and selection of the sample--Dr. Maliche worked with Dr. Cook. The field operation, data collection, data analysis, and report writing, however, have been the responsibility of Dr. Cook.

The writer wishes to acknowledge the significant contributions of Daniel Brown and Francis Brown, Instructors at Wayne State University, as well as Gary Shapiro, Research Assistant, and Miss Mary Mayberry, Research Secretary to the project.

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THE NEED FOR IN-SCHOOL BUSINESS DATA PROCESSING PROGRAMS

SUMMARY

Introduction:

This pilot study was conducted in the Detroit Standard Metropolitan Statistical Area (DSMSA)[1] in 1964-65 to determine the current and projected status of employment in data processing installations to ascertain the need for in-school training programs. Survey research techniques were utilized, and data were collected by personal interviews at 212 companies.

Findings:

1. Data collected by amateur interviewers is as reliable as that collected by professional interviewers.

2. There were more data processing installations in the survey area than had been originally anticipated -- an estimated 424 (March, 1965).

3. There were an estimated 10,740 persons employed as of December, 1964.

4. Sixty percent of all data processing personnel are found in two job classifications -- key punch operator and machine operator.

5. In 1965 and 1966 it is estimated that 3,578 additional personnel will be hired as replacements and additions in existing data processing installations.

6. Basically, a high school education is sufficient for securing employment in a data processing installation. This has been so in the past, is the pattern today, and was the projected pattern for the immediate future in all but two job classifications -- systems analysts and supervisors. In the latter cases, approximately 40 percent of the companies have and will hire persons with no more than high school training for even these two positions.

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[1] Wayne, Oakland, and Macomb counties.

7. Approximately 67 percent of all data processing personnel currently employed had had no previous training in data processing at the time they were hired.

8. Approximately 40 percent of all data processing personnel employed at the time of this study had been hired within the preceeding two years.

Conclusions and Recommendations:

1. A high school education is sufficient for entry into a data processing position.

2. Each year there will be a significant number of jobs in data processing that can be filled by high school graduates.

3. One or more Michigan teacher training institutions should be encouraged (and assisted financially, through acquisition of equipment) to prepare teachers of data processing.

4. The high schools in the DSMSA should be assisted through vocational education funds to acquire necessary equipment and develop appropriate curricula materials to prepare graduates to enter these emerging occupations.

5. This study should be replicated annually to determine:[2]

   A. If the projected hiring rate is actually attained.

   B. How many additional data processing installations have been added.

   C. The total data processing labor force.

   D. Changes in number and percent employed in each job classification.

   E. Changes in educational requirements for data processing personnel.

   F. Changes in equipment used and concomitant need for changes in the training program.

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[2]Such a study is currently being conducted at Wayne State University. See Appendix B for a "short form" of the survey instrument.

INTRODUCTION

This is a report of two studies conducted simultaneously. Both studies were concerned with determining the number and types of jobs available in data processing installations for high school trained personnel. Both studies are identical in every respect except for the types of interviewers used to collect the data: Study A[1] used paid, professional interviewers; Study B[2] used amateur interviewers.

The funded project was conceived as a pilot study to develop an instrument and a survey methodology which could be replicated in other standard metropolitan statistical areas within the State of Michigan or for the entire state.

During the process of securing the list of companies to be interviewed, it was found that there were considerably more data processing installations in the DSMSA than had been anticipated. This made it

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[1]Cook, Fred S., THE NEED FOR IN-SCHOOL BUSINESS DATA PROCESSING PROGRAMS, Wayne State University, Detroit, Michigan (1966). This study was funded by the Division of Vocational Education, Michigan Department of Education in January, 1964.

[2]Brown, Daniel P., A STATUS STUDY OF DETROIT, MICHIGAN AUTOMATIC DATA PROCESSING INSTALLATIONS WITH IMPLICATIONS FOR BUSINESS EDUCATION, an published master's thesis, Wayne State University, Detroit, Michigan (1965).

financially impossible, with the funds available, to personally interview all data processing installations.

It was recognized that a sampling procedure could be developed and a sufficiently large sample could be interviewed within the limits imposed by the available funds. However, since this is a pilot study, and since it was necessary to develop procedures that could be easily used by a local school system, the decision was made to keep the sampling and statistical procedures as simple as possible. Consequently, a simple, one-out-of-two, straight random sample was utilized. This procedure will be explained in detail in a later section.

It was further decided to have a graduate student conduct an identical, parallel study using amateur interviewers. Of primary concern in this study was the question:

> How reliable are data gathered by amateur interviewers having a professional interest in the findings of this study when compared to data collected by experienced professional interviewers in a parallel study?[3]

High school business teachers who were enrolled at Wayne State University as well as business students who were taking a business data processing course were enlisted as our cadre of amateur interviewers. It was the belief that if high school business teachers could be used as interviewers, it would be possible for all school districts to conduct similar studies.

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[3] Op. cit., p.1.

It should be remembered that these two studies were duplicates in every detail with the one exception: the two different groups of interviewers that were utilized for collection of the data.

Statistical analyses, which are described in another section, showed that the data collected by amateur interviewers in Study B were as valid as the data collected by paid, professional interviewers in Study A (i.e., the funded study). Therefore, the data from both studies have been combined into this one report.

STATEMENT OF THE PROBLEM:

Statement. The processing of business data by electronic and electromechanical equipment is creating changes in the traditional office and distributive occupations. Educational programs and requirements for vocational competency must, as a consequence, change also.

The question, however, is how educational offerings must change to prepare students to enter a new kind of work world; more specifically, what the current and projected status of data processing is in the DSMSA--number of installations and employees, turnover, expansion, training.

Significance.

1. Data processing is a new vocational field for which there are few programs in existence at the present time. There are apparently no programs in Michigan that are based upon a detailed analysis of the employment potential and required training.

2. At the time the proposal was prepared it was estimated that there were 80 computer installations with 70 additional installations for the ensuing year, plus approximately 200 unit record installations in the Detroit area. [4]

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[4] This estimate was made by Dr. John W. Sullivan (formerly Professor of Business Data Processing at Wayne State University) in late 1963.

3. Over 90 percent of the persons currently involved in data processing have been trained by data processing manufacturers. With regard to this latter, is this training function one that the schools can and should handle in their educational programs?[5]

OBJECTIVES:

The purpose of this study is to determine the current and projected status of employment in data processing installations in the DSMSA to ascertain the need for in-school training programs.

Before it is possible to develop an educational program, there must be an understanding of the needs. Specifically, answers must be obtained to the following:

1. How many automatic data processing installations are there in the DSMSA? What are the sizes of these installations, and in what types of industries are they found?

2. How many persons are currently employed in data processing installations? What are the employer's projected needs for additional data processing personnel?

3. What type of training is required of persons currently employed in data processing jobs, and where is their training obtained? Have these requirements changed over the past two years, and what changes are anticipated within the next two years? What criteria are used (or contemplated) by employers to determine the suitability of candidates for data processing jobs?

4. What are the employer's attitudes and preferences for particular data processing training organizations?

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[5] Ibid.

DESIGN AND PROCEDURES:

The purpose of this section is to provide interested school personnel with the necessary information to conduct a similar study in their community to determine the need for an in-school data processing training program. The methods of determining the universe, selecting the sample, developing the interview instrument, training the interviewers, as well as analyzing the data will be discussed.

THE SAMPLE:

Preliminary investigations with experts in the field of data processing in Detroit estimated that there would be approximately 200 to 250 installations in the total DSMSA. Further, it was assumed that it would be relatively easy to obtain a list of all data processing installations within this area.

The actual compilation of a master list of all tabulating and computer installations was a very difficult task. Approximately seven months elapsed before all possible known sources were investigated. These sources included:

1. Detroit Yellow Pages.
2. The Detroit Chapter of the Data Processing Manangement Association.
3. Data processing periodicals.
4. University sources.
5. Equipment manufacturers and suppliers.
6. Confidential sources.

After all sources had been utilized, a master list was compiled. This master list was reviewed for possible additons or deletions by persons actively engaged in data processing work. The final master sample contained the names and addresses of all known Automatic Data Processers (ADP) installations in the DSMSA.[6] The master list contained a total of 540 names.

It had been assumed during the development of the project's proposal that personal interviews would be conducted at all known ADP installations in the DSMSA. However, a decision was made to employ a sampling procedure when it was subsequently determined that there were actually 540 separate ADP listings.

The funds available were insufficient to interview <u>all</u> known installations. A one-in-four sample was determined to be sufficient to yield the type of necessary data; this produced a sample of 135 companies. Staff and facilities were available to process 135 additional interviews if amateur interviewers were employed; this produced a total of 270 companies.

The use of amateur interviewers provided the opportunity to double the number of interviews and to conduct two parallel studies. The use of amateur interviewers also provided the opportunity to determine the feasibility of using business teachers as interviewers. The following is a detailed description of the process used for selecting the respondents:

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[6]Divisions of large corporations with self-contained employment facilities and ADP installations were treated as separate units.

1. A card containing the name, address, and telephone number (in some cases the names of the respondents were available) was made for each of the 540 data processing installations.

2. The cards were arranged alphabetically.

3. Utilizing the process of random serial selection, 270 cards were pulled from the deck of 540 cards. These 270 cards represented companies that would be interviewed.

4. The 270 sample cards were divided into two groups by random serial selection: Cards falling into the first group were to be interviewed by professional interviewers (Study A) and the other group by amateur interviewers (Study B).

5. The 135 cards representing companies to be interviewed by amateur interviewers were divided into two groups by the same process of serial selection. One group of companies was to be interviewed by high school business teachers and the other half to be interviewed by business students.

FIELD PERSONNEL:

The interviewers consisted of two groups:

Group A: Fourteen paid, professional interviewers who had been used on previous research projects at Wayne State University and by other research organizations.

Group B: Fifty amateur interviewers from a class in business data processing taught by Professor Francis Brown at Wayne State University.

A consultant was used to conduct the training sessions for both groups of interviewers. The amateur interviewers were trained as a group, and the professional interviewers were trained as a group in separate sessions. Both training sessions were identical: The same basic materials, the same introductory comments, and the same step-by-step training procedures were employed. The training session lasted approximately two hours.

THE INTERVIEW PROTOCOL:

The interview instrument used in this study was developed over a period of approximately four months. Extensive use was made of professional personnel in the initial development of the instrument, which was subjected to a rigorous field testing process. (See Appendix A for copy of instrument.)

The staff responsible for the instruments development and revision consisted of two business teacher-educators, a business teacher, a data processing professor, and a paid consultant in survey research methodology.

For each of the seven revisions an average of three field interviews were conducted by paid, professional interviewers. After each field testing the instrument was revised to incorporate suggestions from the respondents and the interviewers. These revisions included additions and deletions to improve the quality of data secured relevant to the purposes of the study. The physical arrangement of the instrument was also significantly altered during the field testing to facilitate data collection.

FIELD PROCEDURES:

No distinction will be made hereafter between the amateur interviewers and the professional interviewers, since in all cases the procedures employed for the field operation (i.e., collection of the data) and all other subsequent operations (e.g., analysis of the data) were identical. The following are the specific steps employed in the operation:

1. Each interviewer was given a packet containing three interviews. He was instructed to contact the respondents by telephone to make appointments prior to conducting the interviews.

2. As soon as an interviewer had completed one but not more than two interviews, he was instructed to return to campus to have the interview protocol analyzed to determine if he were having problems with the instrument.

3. All subsequent interviews were edited for missing or uninterpretable data by members of the research staff.

4. All incomplete interviews were returned to the interviewer with instructions to contact the respondent in person or by telephone depending upon the nature of the omission so that we could have a complete interview protocol.

CODING:

A 33-page coding guide was developed by our research staff. A team of professional coders was hired to code all questionnaires. The coders were trained and worked under the constant supervision of a research staff member. After each questionnaire was coded and recorded on a code sheet, it was checked a second time for verification.

TREATMENT OF THE DATA:

The data were punched onto IBM cards at the Wayne State University Computing Center, and appropriate machine runs were requested to secure frequency distributions as well as column and row percentages.

Separate decks were maintained for the amateur and the professional interviewers. The deck for the amateur interviewers was further divided into two groups:

Group B-1: Fifty-four respondents who had been interviewed by undergraduate students in Business Administration.

Group B-2: Fifty-four respondents who had been interviewed by graduate students (teachers) in Business Education.

These decks were maintained to determine if there were any statistical differences between the two types of amateur interviewers (i.e., undergraduate and graduate students).

A test of proportions was employed to discover if there were any significant differences at the five percent confidence level between the data collected by the amateur and the professional groups of interviewers. The following formula was employed:[7]

$$Z = \frac{Ps_1 - Ps_2}{-\sqrt{\frac{P_u Q_u}{n_1} + \frac{P_u Q_u}{n_2}}}$$

Ps_1 = Sample$_1$ proportion

Ps_2 = Sample$_2$ proportion

P_u = Estimated population proportion determined by

$$\frac{n_1 Ps_1 + n_2 Ps_2}{n_1 + n_2}$$

$Q_u = 1 - P$

n_1 = Sample$_1$ size

n_2 = Sample$_2$ size

Z = Variation

$H_o : Ps_1 - Ps_2 = 0$

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[7]Hubert M. Blalock, SOCIAL STATISTICS (New York: McGraw-Hill Book Company, Inc., 1960), p.177.

Z was set to 1.96, the value of two standard deviations under which 95 percent of all cases fall. This test was employed due to the nominal type of data related to this study.

FINDINGS:

Two groups of interviewers were utilized for the collection of the data reported in this section. No distinction is made between the data collected by amateur interviewers and those collected by professional interviewers, since statistically there are very few significant differences between these two groups. A more detailed report on this point will be made later in this unit. Data have been collected to secure answers to the eight basic questions in this study. To answer the main point as well as sub-points in each of the questions, each question will be restated and followed by an analysis of the data collected. These data will provide a profile of the automatic data processing installations in the DSMSA.

A detailed analysis of data gathered by the amateur interviewers indicates that these data are highly reliable. Comparatively few statistically significant differences of responses were found between the data collected by this group and that gathered by the professional interviewers.

The coded computer print-out was analyzed using a test of proportions to discover significant differences at the .05 confidence level between the data of the following groups (see pages 10 and 11 for formulas used):

1. The total amateur to the professional: n of 104 to n of 108.

2. The business teacher amateurs to the professionals: n of 54 to n of 108.

3. The undergraduate business administration amateurs to the graduate student business teacher amateurs: n of 50 to n of 54.

The n notation refers to the number of interviews completed by the members of this group -- not the number of persons within the group.

Some of these differences are reported in detail in the following discussion. In each group there were 2,680 individual codes to consider -- 8,040[8] for the three groups. The statistically significant differences of the possible 2,680 in each group are distributed as follows:

1. Seventy-seven[9] significant differences were discovered between interviews completed by the total professional group (n = 108) and the total amateur group (n = 104).

2. Seventy significant differences were discovered between the interviews completed by the business teacher sub-group (n = 54) and the total professional group (n = 108).

3. Twenty-two significant differences were discovered between interviews completed by the business administration sub-group (n = 50) and the business teacher sub-group (n = 54).

The responses that were found to be statistically different fell into three general categories:

1. "No Answers" (82 of this type).

2. Differences in census-type data (29 of this type).

3. Differences in data which involve opinions or predictions (58 of this type).

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[8]Using the 95 percent level it should be expected to find significant differences at the rate of 1 in 20 comparisons merely by chance. Therefore, merely by chance, we should expect 402 significant differences for all three groups.

[9]Merely by chance we should expect 134 significant differences.

NO ANSWERS:

The number of differences here indicates that the amateurs may need more training or more explicit directions on probing techniques. The professionals generally, but not always, had the lesser percentage of "No Answers."

Some of these "No Answers" are simply the result of the respondent not being able to answer the question because of some contingency. This type of variance is anticipated and would not be remedied by improved training activities.

The following is an illustration of a statistically significant difference in "No Answers:"

Question 31: In general, would you say it is difficult to find qualified personnel for the following jobs:

Supervisors No Answer

Business Administration Amateurs	92.0%
Business Education Amateurs	77.7
Total Amateurs	84.6
Professionals	71.2

The above data are to be read as follows: 92 percent of the business administration amateurs and 77 percent of the business education amateurs, etc., received NO ANSWER to this portion of question 31. While all of the percentages are high, the statistically significant differences are between the business administration amateurs and the professionals.

CENSUS-TYPE DATA:

The few differences of this type give an indication of the homogeneous nature of the automatic data processing installations in our area. The number of variations is well within the range of acceptability.

The profile of these installations drawn from the data gathered by either the professionals or the amateurs is essentially the same. The following is an illustration of a statistically significant difference in census-type data:

TYPE OF INDUSTRY

Automatic Data Processing Installations Found in Finance, Insurance, and Real Estate Organizations

Business Administration Amateurs	26.0%
Business Education Amateurs	5.6
Total Amateurs	18.5

The above shows that the statistically significant differences are between the two amateur groups in the number of installations found in this type of industry.

DATA INVOLVING OPINIONS OR PREDICTIONS:

An analysis of the responses speaks well of the ability of the amateurs (business teachers in particular) to gather data without bias. The relatively few statistically significant differences of this type are a noteworthy finding in and of themselves.

There is no pattern to the data gathered by these groups of interviewers which indicates that either has recorded data with bias. The following is an illustration of a statistically significant difference in data involving opinions or predictions:

Question 32. Would you rank the following in terms of their importance for hiring COMPUTER OPERATORS:
1. General education.
2. Training in data processing.
3. Prior work experience, but no formal training in data processing.

Response:
1. Prior work experience, but no formal training in data processing.
2. Training in data processing.
3. General education.

Business Education Amateurs	18.5%
Total Amateurs	12.5
Professionals	4.6

The above shows that 18.5 percent of the business education amateurs found that prior work experience ranked number one when hiring computer operators, whereas only 4.6 percent of the professionals found that prior work experience ranked first.

SUMMARY:

There were only 169 statistically significant differences (at the .05 confidence level) out of a possible 8,040 codes. With 8,040 codes, 402 significant differences could have been anticipated.

RESULTS OF FIELD WORK:

Of the 270 companies in the sample, data were collected on 212 companies. Table 1 below shows the reasons that the remaining 58 companies were not interviewed:

Table 1

Disposition of Non-Completed Interviews

Types of Non-Interviews	Number of Companies
Non-Interviews:	
Refusals	3
Unable to Interview[1]	4
Classified Installation (U.S. Government)	1
Sub-Total	8
Non-Sample:	
No Data Processing Equipment	33
Duplicate Interviews	10
School: Teaching Only	3
Outside Sample Universe	2
Discontinuing Data Processing Installation	1
Out of Business	1
Sub-Total	50
TOTAL	58

[1]These companies were reorganizing their installations and were not available for interviews within our allotted time period.

Although 58 of the 270 companies from the master list were not interviewed, it should be noted that only eight of the 58 companies were eligible for interviewing. The other 50 companies were included on the master list as a result of inaccurate data concerning the total number of ADP installations in the DSMSA.

1. How many automatic data processing installations are there in the DSMSA? What are the sizes of these installations and in what types of industries are they found?

Analysis of Table 2 indicates that approximately one-third of all ADP installations in the DSMSA are found in the construction and manufacturing durable industries, while another one-third of these installations are found in the combination of finance, insurance and real estate, and business and personal services.

As might be expected, two companies found in the construction and manufacturing (includes automobile manufacturers) category employed more than 500 employees in their ADP installation. No other business categegory employed more than 400 employees, and only five companies in all categories employed more than 100 but less than 500 employees.

Data processing installations in construction and manufacturing firms are over-represented in this study when compared with their representation for all types of businesses in the tri-county area. Construction and manufacturing firms comprise less than 16 percent of all business enterprises in the DSMSA, but over 32 percent of this type of business have data processing equipment.

Data processing equipment is also more prevalent in firms involved in finance, insurance, and real estate. These companies comprise less than eight percent of the total business population, but 17 percent of the companies have data processing equipment.

Table 2

Distribution of Companies by Size and Type of Business

Type of Business	Total by Type of Business		Size of Companies in Sample by Number of Data Processing Employees									
			Fewer than 4		4 - 24		25 - 99		100 - 500		More than 500	
	Number	Per-cent	Number	Per-cent	Number	Per-cent	Number	Per-cent	Number	Per-cent	Number	Per-cent
Construction and Manufacturing Durable	68	32.2	16	7.6	42	19.9	8	3.8	--	--	2	.9
Manufacturing Non-Durable	23	10.9	5	2.4	14	6.6	3	1.4	1	.5	--	--
Warehouse and Wholesale Trade	18	8.4	6	2.8	10	4.7	2	.9	--	--	--	--
Retail Trade	7	3.3	1	.5	4	1.9	2	.9	--	--	--	--
Finance, Insurance, and Real Estate...	36	17.0	8	3.8	23	10.8	4	1.9	1	.5	--	--
Business and Personal Services.	36	16.9	11	5.1	23	10.8	1	.5	1	.5	--	--
Non-Profit	5	2.4	1	.5	1	.5	1	.5	2	.9	--	--
Entertainment and Professional Services	19	8.9	11	5.1	7	3.3	1	.5	--	--	--	--
Total by Size ...	212	100.0	59	27.8	124	58.5	22	10.4	5	2.4	2	.9

NOTE: This table is to be read that of 68 companies in the construction and manufacturing business that had data processing equipment, 16 hired fewer than four data processing employees, 42 hired between 4-24 employees, etc.

Figures on this table represent number of companies in the sample. To expand figures to include all data processing installations in the DSMSA use the inflation factor of twice the figures in our sample.

Retail firms, on the other hand, comprise over 31 percent of all businesses in the DSMSA, but less than four percent of these companies have data processing equipment.[10]

Table 3 indicates that half (114) of the ADP installations had no computer. Only 27 of the companies were identified as large installations.[11] In installations in which no computer was found, almost half of the companies employed fewer than four persons to operate the electromechanical equipment. Almost 100 percent of these companies employed fewer than 25 persons.

In the medium installations there is a higher percentage found in the 4-24 employee range. However, again, no company in this size installation employed 100 or more employees.

In the large installations, note that there are no companies employing fewer than four employees. The majority (20-27), however, still employ fewer than 100 persons. Every company of 100 or more employees has an installation classified as large.

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[10] Figures on number of companies by type of business in the DSMSA are from County Business Patterns, Part 4-A, First Quarter, U.S. Bureau of Census (1962), pp. 112-113.

[11] Size of installation computed on basis of size of computer: Small installation -- no computer; medium installation -- one small or medium computer; and large installation -- one large computer or two small or medium computers.

Small Computers (rental less than $3,000 per month): IBM 1620, 1440, 1001; NCR 310, 390; TWR 530; UNIVAC 1004. Medium Computers (rental $3,000 to $10,000 per month): IBM 1460, 1401, 1230, 701, 702, 650, 1410; NCR 315; Burroughs 204, 260; RCA 301; UNIVAC Solid State 90; GE 225, G15; Philco 1000; Honeywell 200. Large Computers (rental over $10,000 per month): IBM 7000 Series, 6400, 704, 705; Burroughs ss0, 5500, 5000; RCA 501; UNIVAC II; Honeywell 800; Philco 211, 2000.

Table 3

Number of Installations by Type of Data Processing Equipment

TYPE OF INSTALLATION BY SIZE OF EQUIPMENT	NUMBER OF COMPANIES BY TYPE OF INSTALLATION		NUMBER OF INSTALLATIONS BY SIZE OF COMPANY (BY NUMBER OF DATA PROCESSING EMPLOYEES)									
			Fewer than 4		4 - 24		25 - 99		100 - 500		More than 500	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Small Installation: No Computers	114	54.2	52	24.8	60	28.6	2	1.0	--	--	--	--
Medium Installation: One Small or Medium Computer	69	32.9	7	3.3	55	26.2	7	3.3	--	--	--	--
Large Installation: One Large Computer or Two Small or Medium Computers	27	12.9	--	--	7	3.3	13	6.2	5	2.4	2	1.0
Total	210[a]		59		122		22		5		2	

[a] Two respondents did not answer this question.

2. How many persons are currently employed in data processing installations? What are the employers' projected needs for additional data processing personnel?

Table 4

Number of Companies Utilizing Personnel by Job Titles Studied

Job Titles	Number of Companies Employing Personnel by Job Titles Studied	Number of Companies That Hired Personnel in Past Two Years by Job Titles Studied
Key Punch Operators	204	136
Machine Operators..	189	79
Computer Operators.	105	62
Programmers.....	109	46
Systems Analysts...	88	33
Supervisors[1].....	60	21
	(N = 212)	(N = 212)

[1]Information on supervisors is shown only for companies who volunteered information; therefore, the number of companies employing data processing supervisors reported here is undoubtedly below actual number.

It is significant to note from the above table that not all companies employ a complete data processing staff. Part of this can be accounted for by the size of the installation, and, of course, by the type of equipment. Another factor, apparently, is the services that are secured from the manufacturers; that is, pre-wired boards decrease the need for programmers.

Another important factor to be noted is the high percentage of companies that had not hired data processing personnel during 1963-1964. Perhaps there is less turnover in data processing personnel than in other job classifications.

Table 5

Total Number of Data Processing Personnel by Job Titles

JOB TITLES	TOTAL: CURRENTLY EMPLOYED (1964)		NUMBER AND PERCENT HIRED IN LAST TWO YEARS (1963 and 1964)	
	Number	Percent	Number	Percent
Key Punch Operators	2,377	44.3	1,133	56.9
Machine Operators..	922	17.2	261	13.1
Computer Operators.	551	10.3	186	9.3
Programmers.....	549	10.2	194	9.8
Systems Analysts...	591	11.0	167	8.4
Supervisors.....	380	7.0	50	2.5
Total.....	5,370	100.0	1,991	100.0

Table 5 indicates that approximately three-fifths of all the persons employed in ADP installations are found in two job titles -- key punch operators (44.3%) and machine operators (17.2%). It is interesting to note that almost half of the currently employed key punch operators were hired in the past two years. Furthermore, key punch operators accounted for almost 57 percent of all data processing personnel hired during this period. The second highest number of employees is machine operators; however, it should be noted that less than one-fifth of these employees were hired within the past two years.

The numbers of computer operators (551), programmers (549), and systems analysts (591) found in these ADP installations are surprisingly similar. Almost two-fifths of these employees (i.e., computer operators, programmers, and systems analysts) were hired within the past two years.

The supervisory category shows the least number (380) of currently employed data processing personnel as well as the smallest percentage (2.5%) of new employees hired within the past two years. The total figures in Table 5 indicate that nearly two out of every five of the currently employed data processing employees were hired within the past two years.

Table 6 on the next page indicates that the majority of key punch operators and machine operators hired within the past two years were hired as replacements, while computer operators hired within this same time period were fairly evenly divided between additions (4.6%) and replacements (4.8%). The majority of employees hired in all other job categories were additions to the data processing staff.

Table 6 also indicates that the vast majority of persons hired as key punch operators, machine operators, computer operators, and programmers were hired from outside the organization, while systems analysts and supervisors tended to be hired from within the organization as a result of transfers.

A summary of Table 6 indicates that the majority of the currently employed data processing employees hired within the past two years were hired as replacements and nearly three-fourths of these employees were hired from outside of the organization.

Table 6

Distribution of Data Processing Personnel Hired in Past Two Years
(1963 and 1964)

JOB TITLES	TOTAL NUMBER HIRED IN LAST TWO YEARS		NUMBER OF ADDITIONS AND REPLACEMENTS				NUMBER HIRED FROM OUTSIDE AND TRANSFERS			
			Additions		Replacements		Outside		Transfers	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Key Punch Operators	1,133	56.9	414	20.8	719	36.1	957	48.1	176	8.8
Machine Operators..	261	13.1	110	5.5	151	7.6	171	8.6	90	4.5
Computer Operators.	186	9.3	91	4.6	95	4.8	120	6.0	66	3.3
Programmers.....	194	9.8	132	6.6	62	3.1	139	7.0	55	2.8
Systems Analysts...	167	8.4	88	4.4	79	4.0	73	3.7	94	4.7
Supervisors.....	50	2.5	29	1.5	21	1.0	12	.6	38	1.9
Total.....	1,991	100.0	864	43.4	1,127	56.6	1,472	74.0	519	26.0

This table is to be read: Of the 1,133 key punch operators hired in the last two years, 414 were additions, 719 were replacements; and 957 of these 1,133 key punch operators were hired from outside of the company, while 176 were transferred to this job from some other job.

Table 7

Projection of Employment Trends by Job Titles for Next Two Years (1965 and 1966)

JOB TITLES	ESTIMATED NUMBER TO BE HIRED IN NEXT TWO YEARS		ESTIMATED NUMBER OF ADDITIONS AND REPLACEMENTS			
			Additions		Replacements	
	Number	Percent	Number	Percent	Number	Percent
Key Punch Operators	955	53.4	283	15.8	672	37.6
Machine Operators..	151	8.4	61	3.4	90	5.0
Computer Operators.	204	11.4	100	5.6	104	5.8
Programmers.....	216	12.1	127	7.1	89	5.0
Systems Analysts...	214	12.0	147	8.2	67	3.7
Supervisors.....	49	2.7	13	.8	36	2.0
Total.....	1,789	100.0	731	40.9	1,058	59.1

Note: This table is to be read that of the 955 key punch operators to be hired within the next two years, 283 will be additions to the staff and 672 will be replacements.

The estimated number (1,789) of persons to be hired in all job classifications seems to be quite consistent with the number (1,991) who have been hired in the past two years with one exception--machine operators. There is an apparent and anticipated decline in the need for machine operators, while the need for persons in all other job classifications appears to be relatively stable. This anticipated lack of growth (or lack of need) is particularly apparent in that the majority of machine operators will be hired as replacements rather than as additions. There is a slight decline in the anticipated need for key punch operators, but all other anticipated needs appear to be consistent with the previous two years.

The range of anticipated "growth" by job classifications through additional staff members is from 15.8 percent to 0.8 percent, or an average of 6.8 percent. During the preceding two years this range (Table 6) was from 20.8 percent to 1.5 percent, or an average of 7.2 percent.

3. What type of training was required of persons currently employed in data processing jobs and where was their training obtained? Have these requirements changed over the past two years, and what changes are anticipated within the next two years? What criteria is used (or contemplated) by employers to determine the suitability of candidates for data processing jobs?

Table 8

Analysis of Training Institutions Used for Data Processing Personnel Hired in Past Two Years (1963 and 1964)

Job Titles	Number Hired In Past Two Years	Manufacturer Trained	Trained by Other Schools	Trained on Previous Job	Untrained
Key Punch Operators	1,133	157	231	75	670
Machine Operators	261	67	24	47	123
Computer Operators	186	72	20	37	57
Programmers	194	31	8	11	144
Systems Analysts	167	81	--	7	79
Supervisors	50	26	2	3	19
Total	1,991	434	285	180	1,092
(Percent of Total: 1,991)	(100.0%)	(21.8%)	(14.3%)	(9.0%)	(54.9%)

Two important facts are important from Table 8 above concerning key punch operators:

1. More key punch operators were trained in schools other than those operated by the manufacturers.

2. Better than half of all key punch operators were untrained at the time they were hired.

More machine operators were trained at the manufacturer's school than in other training sources, but approximately one-third of all machine operators were untrained. A third of all computer operators were hired untrained, but where training was indicated the majority of the machine operators had been trained by the manufacturer's school.

A very large majority of programmers hired were untrained, but where training did occur it was at the manufacturer's school. A sizeable number of both systems analysts and supervisors were untrained when hired; but, again, where training was indicated these persons had been trained by the manufacturer's school.

A significant fact is that almost 55 percent of all persons hired for all job classifications listed were untrained at the time they were hired. That is, more than one-half of the people hired by these employers were hired without having had <u>any formal training prior to employment</u> in data processing installations.

A question might be raised concerning the need for <u>training prior to employment</u>; or it might be assumed that these data indicate an urgent need for some type of pre-employment training in all facets of data processing.

Contrary to popular opinion (and the mystique of data processing), a college education was not a prerequisite for securing a job in a data processing installation. During the past two years (1963 and 1964), without exception, every job classification had been filled by individuals with a high school education or less in over 50 percent of the cases. Where additional education was required, a junior college program was as adequate as a college program in every job classification with the exception of systems analysts.

Table 9 indicates the types of educational backgrounds that were demanded as a prerequisite for hiring. It does not, of course, indicate that if more adequately educated (i.e., more years of formal education) personnel had been available the requirements would have been the same.

Table 10, on page 31, illustrates that the respondents would like to require a greater degree of formal education. It should be remembered that this question was asked of all respondents, and that approximately two-thirds of the companies responding to this question had not hired within the preceding two years. Consequently, it is not known if this was merely a "wish" or a "requirement" that had to be met.

High school education or less was sufficient for all job classifications in over 50 percent of the cases with the exception of systems analysts and supervisors. With the exception of these job classifications a junior college education or less was acceptable in over 80 percent of the cases.

Table 9

Respondents' Educational Requirements by Job Titles for Persons Hired in Past Two Years[1]: 1963 and 1964 (In Percents)

Educational Requirement	Key Punch Operators	Machine Operators	Computer Operators	Programmers	Systems Analysts	Supervisors
High School or Less.....	98.5%	97.5%	91.9%	67.4%	54.5%	52.4%
Junior College.....	--	2.5	6.5	19.6	15.2	19.0
Bachelor's Degree.....	--	--	2.6	13.0	27.3	19.0
Don't Care.....	1.5	--	--	--	3.0	4.8
Don't Know and No Answer.	--	--	--	--	--	4.8
	(N=136)	(N=79)	(N=62)	(N=46)	(N=33)	(N=21)

[1] This information was asked only of companies who hired in the past two years. That is, if a company hired only key punch operator(s) in the last two years, the respondent was asked the question for just key punch operators.

Table 10

Respondents' Educational Requirements by Job Titles If Hiring Personnel Today[1]

(In Percents)

Educational Requirement	Key Punch Operators	Machine Operators	Computer Operators	Programmers	Systems Analysts	Supervisors[2]
High School or Less.....	97.2%	85.8%	73.1%	52.7%	40.1%	44.4%
Junior College.....	.5	7.6	14.6	23.2	14.6	16.7
Bachelor's Degree.....	.5	1.9	6.6	18.4	35.8	36.1
Don't Care.....	.9	.9	--	--	--	--
Don't Know and No Answer.	1.4	3.8	5.7	5.7	9.5	2.8
	(N=212)	(N=212)	(N=212)	(N=212)	(N=212)	(N=36)

[1]This question was asked of all respondents; that is, the question was asked even if the company did not hire programmers.

[2]Percents figured only on number of respondents (N=36) who volunteered data for this job title.

For the immediate time, a high school education is sufficient for most job classifications. In fact, 40 percent of the respondents indicated that if they were currently hiring they would not require more than this level of education for such job classifications as systems analysts and supervisors. These data raise serious questions about the need for a college degree as an entry requirement for a career in data processing.

Table 11 indicates that the majority of companies expect their educational requirements will remain the same. However, there is an indication that the more difficult the job the more apt the educational requirements are to be changed. The only job classification that will not have higher educational requirements is that of computer operator.

The training and experience requirements appear to be on a somewhat downward trend. It appears that more companies will be lowering their training and experience requirements than those that will be maintaining the same requirements. Approximately 20 percent of the companies, on the other hand, will be raising these requirements. This trend may indicate that data processing employers experienced difficulty in obtaining personnel who could meet their requirements.

Table 11

Comparison of Current and Past Requirements for Hiring Data Processing Personnel (by Job Title)
(By Percent)

JOB TITLES	EDUCATIONAL REQUIREMENTS			TRAINING AND EXPERIENCE REQUIREMENTS		
	Same	Lower	Higher	Same	Lower	Higher
Key Punch Operator	93.0	0.7	6.3	38.8	40.9	20.3
Machine Operator	91.3	1.7	7.0	31.2	43.0	25.8
Computer Operator	79.1	13.4	7.5	34.7	46.9	18.4
Programmer	74.1	10.2	15.7	31.0	53.3	15.7
Systems Analyst	64.9	16.1	19.0	35.4	49.7	14.9
Supervisor	81.6	6.6	11.8	13.6	65.2	21.2

This table is to be read: 93 percent of the companies hiring key punch operators will have the same educational requirements in the future as in the past; 0.7 percent will have lower, and 6.3 percent, higher, etc.

Table 12

Respondents' Expectations of Providing Additional On-the-Job Training

Job Titles	Yes	No
Key Punch Operators	123	27
Machine Operators..	140	15
Computer Operators.	149	11
Programmers.....	151	12
Systems Analysts...	145	20
Supervisors.....	30	3

This table is to be read: Of the companies hiring key punch operators, 123 expect to administer additional training and 27 do not.

The question in Table 12 was asked only of companies that indicated they would demand training and/or experience. If they did not have either of these requirements, it is assumed they will provide on-the-job training.

The important point to note in Table 12 is that the majority of companies expect to provide additional training for new hires in all job classifications studied. This expectation on the part of the respondents may hold significant keys for business educators. For example, why do so many companies anticipate the necessity of giving additional training? How extensive is this training? Is it merely "over-the-shoulder," "learn our way" training, or is it basic principles and skills? Can the business education departments fill an obvious need by developing relevant training programs?

In concluding this section on requirements, it should be noted here that the respondents indicated a decided preference for male employees in all job classifications studied with the exception of key punch operators:

There was an almost unanimous preference for female key punch operators (see Tables I and II, Appendix C).

The majority of respondents also indicated that they had no minimum or maximum age requirements, but in cases where there were age restrictions for employment it was most likely a minimum rather than a maximum restriction. Company policy and maturity were the reasons most frequently given as having a minimum age requirement (see Tables III and IV, Appendix C).

4. What are the employers' attitudes and preferences for particular data processing training organizations?

Table 13

Distribution of Respondents' Preferences
by Type of Data Processing Training Institution

Training Institution	Number of Companies	Percentage
Business School.....	17	8.0
Manufacturer's School..	142	67.0
Public School.....	19	9.0
All the Same.....	14	6.6
Don't Know.....	20	9.4
Total.....	212	100.0

It is seen from Table 13 above that a substantial majority of the respondents indicated a preference for manufacturer trained personnel. However, it is also interesting to note that approximately 15 percent indicated a preference for the public school, or they felt that all schools were about the same, while another 10 percent, due to their limited experience, did not feel they knew of enough distinction between the different training institutions. This is quite interesting because of the very limited number of ADP employees produced at this time by the secondary school system. This might appear to be an advance endorsement of what the employers expect to secure from public high school data processing training programs.

Table 14

Distribution of Respondents' Preferences
of Institutions Providing Training
for Key Punch and Machine Operators

Training Institutions	Number of Companies	Percentage
Public High School	45	21.2
Manufacturer's School ...	117	55.2
No Difference Between Public High School and Manufacturer's School .	26	12.3
Don't Know	20	9.4
No Answer	4	1.9
Total	212	100.00

Table 14 shows that when the respondents were asked to indicate a preference for "manufacturer trained" or "high school trained" key punch and machine operators, the majority indicated a preference for manufacturer trained personnel for these jobs, but a sizeable percentage (21.2%) indicated they would find high school training acceptable.

The significant point on Table 15 is the low number of respondents that indicated a preference for college-trained programmers. It appears that the manufacturer trained programmer is more desirable to the respondents. However, it should also be noted that 21 percent of the respondents indicated that the training institution of the programmer was of little or no importance.

Table 15

Distribution of Respondents' Preferences of Institutions Providing Training for Programmers[1]

Training Institution	Number of Companies	Percentage (N-109)
High School or College..	24	22.0
College.....	14	12.8
Manufacturer's School...	44	40.4
Doesn't Matter.....	23	21.1
No Answer.....	4	3.7
Total	109	100.0

[1]This question was asked of only companies that employed programmers.

Analysis of Table 16 shows that "experience" was rated as the most important variable for key punch and machine operators, "training" for computer operators, and "education" for programmers, systems analysts, and data processing supervisors. This finding seems to indicate that the lower the job classification the more important "experience" becomes, and the higher the job classification the more important is "education."

Table 16

Distribution of Respondents' Ranking of Preferred Prerequisites for Hiring of Personnel by Job Titles

Job Titles	RANKING OF RESPONDENTS' PREFERENCE OF HIRING PREREQUISITES: 1 = General Education. 2 = Training in Data Processing 3 = Prior Work Experience, but No Formal Training in Data Processing												No Answer	
	Gen. Ed. Training Prior Exp.		Gen. Ed. Prior Exp. Training		Training Gen. Ed. Prior Exp.		Training Prior Exp. Gen. Ed.		Prior Exp. Gen. Ed. Training		Prior Exp. Training Gen. Ed.			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Key Punch Operators (N=204)	22	10.8	25	12.3	37	18.1	12	5.9	47	23.6	38	18.6	23	11.3
Machine Operators (N=189)	17	9.0	7	3.7	34	18.0	9	4.8	39	20.6	40	21.2	43	22.7
Computer Operators (N=105)	20	19.0	6	5.7	23	21.9	9	8.6	18	17.1	18	17.1	11	10.6
Programmers (N=109)	21	19.3	7	6.4	16	14.7	12	11.0	17	15.6	8	7.3	28	25.7
Systems Analysts (N=90)	29	32.2	13	14.4	15	16.7	8	8.9	14	15.6	11	12.2	--	--
Supervisors (N=60)	14	23.4	5	8.3	8	13.3	5	8.3	7	11.7	10	16.7	11	18.3

NOTE: Figures are rounded to nearest unit of percent.

This table is to be read: Out of 204 companies hiring key punch operators, 22 respondents ranked general education first, training second, and prior work experience third; 25 companies ranked general education first, prior work experience second, and training third; etc.

Table 17

Job Titles for Which Respondents Had Difficulty in Finding Qualified Data Processing Personnel[1]

(In Percents)

Job Titles	Had Difficulty in Hiring		Don't Know and No Answer
	Yes	No	
Key Punch Operators (N=204)	39.2%	48.5%	12.3%
Machine Operators (N=189)	37.0	36.0	23.0
Computer Operators (N=105)	54.3	32.4	13.3
Programmers (N=109)	56.0	13.8	30.2
Systems Analysts (N=88)	71.6	19.3	9.1
Supervisors (N=60)	56.7	20.0	23.3

[1]Respondents were asked question only for job titles for which company employed personnel. That is, if a company hired only key punch and machine operators, the question was asked for just these two job classifications.

This table is to be read: Of the 204 companies that employ key punch operators, 39.2 percent said they had experienced difficulty in obtaining qualified personnel, 48.5 percent had no difficulty, and 12.3 percent had no recent experience in attempting to hire personnel or did not respond to this question.

The above table indicates that there is no apparent majority opinion that it is difficult to find key punch and machine operators. However, on the other hand, there is a majority opinion that it is

difficult to find qualified personnel for all job classifications from computer operators down to data processing supervisors.

Table 18 gives an overview of the current and projected personnel needs for the estimated 424 data processing installations in the DEMSA. The 424 figure and the totals reported in Table 18 were computed by multiplying the data collected from the total sample by an expansion factor of 2.[1]

The estimated 3,578 staff members to be added in 1964 and 1966 compared favorably with the 3,982 actually hired in 1963 and 1964. These figures indicate a continuing need for personnel in existing installations. It is assumed that there will also be a need for personnel in a number of new installations during the same period of time. The significant point in Table 18 is the fact that approximately two out of five of those hired in the past two years had no previous training in data processing.

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[1] One half of the eligible installations were surveyed.

Table 18

Status of Data Processing Personnel in Detroit Metropolitan Statistical Area

	Total: All Job Classifications	Key Punch Operators	Machine Operators	Computer Operators	Programmers	Systems Analysts	Supervisors
CURRENTLY EMPLOYED	10,740	4,734	1,844	1,102	1,098	1,182	760
HIRED IN PAST TWO YEARS	3,982	2,266	522	372	388	334	100
Additions to Staff	1,728	828	220	182	264	176	58
Replacements on Staff	2,254	1,438	302	190	124	158	42
Hired from Outside	2,944	1,914	342	240	278	146	24
Transfers	1,038	252	180	132	110	198	76
TRAINED BY MANUFACTURER"S SCHOOL	868	314	134	144	62	162	52
TRAINED BY OTHER SCHOOLS	570	462	48	40	16	--	4
TRAINED ON PREVIOUS JOB	360	150	94	74	22	14	6
HIRED UNTRAINED	2,184	1,340	246	114	288	158	38
ESTIMATED NUMBER TO BE HIRED IN NEXT TWO YEARS	3,578	1,910	302	408	432	428	98
Estimated Additions to Staff	1,462	566	122	200	254	294	26
Estimated Replacements on Staff	2,116	1,344	180	208	178	134	72

NOTE: Summary sheet of personnel questions has been inflated by two to represent the total universe.

CONCLUSIONS:

Based upon the data collected in this study, the following conclusions seem appropriate:

1. Data collected by high school business teachers and/or college business administration students were as reliable as data collected by paid professional interviewers. This finding makes it feasible for a high school business department to utilize its staff members in the collection of similar data within its community.

2. Original estimates had predicted approximately two hundred data processing installations. There were actually 424 such installations. The number of computers, however, was smaller than anticipated.

3. For those installations that had computers, a series of definitions was developed to identify the size of the installation. (See p. 19.) Over half, 54.3 percent, of computer installations are defined as small, 32.9 percent, medium, and only 12.9 percent, large.

4. Approximately 67 percent of the data processing installations were found in three Standard Industrial Classifications. One-third were in the Construction, Manufacturing classification, and approximately 17 percent in financial, business and personal service.

5. One of the major concerns of the study was a determination of the number of personnel employed in data processing installations. As of December, 1964, there were an estimated 10,740 employed in six job classifications. Approximately 60 percent of these personnel were employed in two job classifications -- keypunch operator and machine operator.

6. While data are not available to predict the number of personnel needed for new data processing installations, it is estimated that 3,578 additional personnel will be required in 1965-66 for existing installations. Two-thirds of these personnel will be employed in two job classifications -- keypunch operator and machine operator.

7. Another concern of this study was the determination of the level of education required for those individuals currently employed in a data processing installation. In over 90 percent of the current jobs, a high school education was sufficient.

9. When respondents were asked if their educational requirements had been changed within the past two years or if they expected to change in the next two years, most of them indicated little or no change. For systems analysts and supervisors they indicated a slightly higher educational requirement than they had had for the preceding two years. However, a high school education or at most a junior college program will be sufficient for at least 80 percent of all jobs in a typical data processing installation.

10. When the employers were asked their preference for a particular data processing training organization two-thirds stated they preferred a manufacturer's school. Surprisingly, public schools were rated slightly higher than private business schools.

11. Approximately two-thirds of all data processing personnel currently employed at the time this study was made had had no previous training in data processing at the time they were hired. This lack of previous training was found in all six job classifications.

12. The number of personnel required each year in data processing has apparently been quite high. Specifically, 40 percent of all data processing personnel employed at the time of this study had been hired within the preceding two years.

RECOMMENDATIONS:

Based upon the preceding conclusions drawn from this study, the following recommendations are offered;

1. At the present time, it appears that there will be a significant number of jobs opening each year in data processing that can be filled by high school graduates. Consequently, it is recommended that:

   A. One or more Michigan teacher training institutions should be encouraged (and assisted financially through vocational education to acquire equipment) to prepare teachers of data processing.

B. The high schools in the DSMSA should be assisted through vocational education funds to acquire necessary equipment and develop appropriate curricular materials to prepare graduates to enter these emerging occupations.

2. Immediate attention should be given to funding through state vocational education funds a state-wide study with concentration in the metropolitan areas in the state that have been designated as standard metropolitan survey areas. These data should be coordinated into a final report which would show the status and projected employment trends for the entire state in the emerging field of data processing.

3. The current study which was confined to the DSMSA should be replicated annually to determine:

   A. If the projected hiring rate is actually attained.

   B. How many data processing installations have been added.

   C. The total data processing labor force.

   D. Changes in number and percent employed in each job classification.

   E. Changes in educational requirements for data processing personnel.

   F. Changes in equipment used and concomitant need for changes in the training program.

APPENDIX A

ORIGINAL INSTRUMENT

WAYNE STATE UNIVERSITY
College of Education
Department of Business & Distributive Education

THE NEED FOR EDUCATIONAL PROGRAMS IN BUSINESS DATA PROCESSING

Interview Number: _____

Company: _____

Address: _____

Telephone Number: _____

Contact: _____

Interviewer: _____

Industry: _____

Respondent's Job Title: _____

If Respondent Different Than Contact:

Name: _____

Report: Yes _____ No _____

Appointment: Date _____ Time _____ AM PM

Time Began: _____ Time Completed: _____

Editing Time: _____

Call Backs		
Date	Time	Explanation

1. Would you tell me which of the following machines you have? (CHECK " ✓ " IN COLUMN 1.)

FOR EACH MACHINE CHECKED, ASK QUESTIONS 2-4.

2. How many _____ machines do you have? (RECORD IN COLUMN 2.)

3. Who is the manufacturer? (RECORD IN COLUMN 3)

4. Do you own or rent your machines? (RECORD "O" OR "R" IN COLUMN 4.)

5. In what year did you obtain your first data processing machine(s)?

_____
(YEAR)

6. What was the first machine(s) you obtained? (CHECK " ✓ " IN COLUMN 6.)

	1 (✓)	2	3	4	6 (✓)
Key Punch					
Verifyer					
Sorter					
Collator					
Reproducer					
Interpretor					
Printer (402, Tab., Accounting.)					
Computer (specify): 1					
2					
Other 1					
2					
3					
4					

*Just the main computer unit should be named, not the various parts or attachments; e.g., IBM 1401, UNIVAC.

	7. How many of the following employees do you have in this company? (OTHER DATA PROCESSING JOBS THAT REQUIRE TRAINING?)	8. How many of these ___ were hired within the last two years? (IF NO NEW EMPLOYEES IN ANY CATEGORY: SKIP TO QUESTION 22 ON PAGE 6.)	9. How many of these were additions and how many were replacements for employees who had left?		10. Of these new ___, how many were hired from outside the company and how many were transferred from other departments within the company?		11. I would like to know your company or department policy regarding schooling. Of these new ___, how much formal schooling did you DEMAND before hiring them? (SHOW CARD 1 AND RECORD LETTER.)
			Additions	Replacements	Outside	Transferred	
Key Punchers							
Machine Operators							
Computer Operators							
Programmers							
Systems Analysts							
Other: 1							
2							
3							

	Hired Last Two Yrs. (✓)	12. Did you DEMAND that these ___ be trained in data processing before you would hire them? (CIRCLE BELOW.)	IF YES TO Q 12 — 13. How many of these ____ employees were trained by the:				14. Did you DEMAND THAT these ___ have experience in data processing before you would hire them? (CIRCLE BELOW.) (IF NO TO Q 12 AND 14: SKIP TO Q 19)
			Manufacturer (e.g., IBM School)	Another Type of Data Processing School	On A Previous Job	Trade Associations	
Key Punchers		YES NO					YES NO
Machine Operators		YES NO					YES NO
Computer Operators		YES NO					YES NO
Programmers		YES NO					YES NO
Systems Analysts		YES NO					YES NO
Other: 1		YES NO					YES NO
2		YES NO					YES NO
3		YES NO					YES NO

IF YES TO QUESTION 12 AND/OR QUESTION 14:				IF NO TO Q 12 AND 14
15. Of the ___ hired within the last two years, how many are now operating machines for which they had no training or experience prior to employment here?	IF ONE OR MORE: 16. Would you look at this card and choose the answer that best explains why this happened? (SHOW CARD 2 AND RECORD LETTER BELOW.)	17. Of the ___ hired within the last two years, did you find it necessary to give them additional training once they were on the job? (CIRCLE BELOW.)	IF YES TO Q 17 18. Was this because: (a) your operation requires specialized training or (b) they did not receive enough training prior to employment here? (RECORD LETTER BELOW AND IF OTHER SPECIFY.)	19. Would you look at this card and tell me which answer best explains why you were willing to take untrained or inexperienced personnel? (SHOW CARD 3 AND RECORD LETTER BELOW.)
		YES NO		
		YES NO		
		YES NO		
		YES NO		
		YES NO		
		YES NO		
		YES NO		
		YES NO		
		YES NO		

20. How many of the employees whom you hired in the last two years wire boards (set switches for UNIVAC) as part of their normal job? (RECORD IN COLUMN 21.)

IF NONE: 20a. Who does wire the boards? (GET JOB TITLE; THEN SKIP TO QUESTION 21, PAGE 6.)

_____

IF ONE OR MORE:

20b. Where did they learn to do this? (RECORD LETTER IN COLUMN 20b.)

a. on this job
b. manufacturer
c. other data processing schools
d. previous work experience

IF B THROUGH D ON QUESTION 20b:

20c. Did you require this training before hiring them?

YES NO (CIRCLE IN COLUMN 20c)

IF B OR C ON QUESTION 20b:

20d. Did you send them to school or did they go before you hired them? (RECORD LETTER IN COLUMN 20d.)

a. sent them
b. prior to hiring

Job Title	20	20a	20c	20d
			Y N	
			Y N	
			Y N	
			Y N	

21. Of the personnel you hired within the last two years, did you DEMAND any skillys other than the ones we have already mentioned?

Yes _____ No _____

IF YES:

21a. Job Title	21b. What skills?

22. Are there any data processing jobs for which you have a minimum or maximum age requirement?

Yes ____ No ____ (IF YES: RECORD BELOW.)

Job Title	AGE		Could you tell me why?
	Minimum	Maximum	

23. Are there any data processing jobs for which you hire only men?

Yes _____ No _____

IF YES:

Job Title	Sex	Could you tell me why?
	M W	
	M W	
	M W	
	M W	

24. Are there any jobs for which you hire only women?

Yes _____ No _____

IF YES: List above asking all questions.

25. Do any of your employees do work other than on data processing machines as part of their normal job?

Yes _____ No _____

IF YES:

25a. which employees? (Job Title)	25b. How many?	25c. Would you look at this card and tell me which job classification their other work best fits into? (SHOW CARD 4 AND RECORD LETTER BELOW.	25d. What percent of time on other work?

ASK ABOUT ALL JOB TITLES LISTED BELOW.	26. If you were hiring new ___ today or in the near future, what is the minimum formal schooling you would demand? (SHOW CARD 1 AND RECORD LETTER)	27. If you were hiring new ___ today would you DEMAND that they have training in data processing before you would hire them? (CIRCLE BELOW.)	28. If you were hiring ___ today, or in the near future, would you DEMAND that they have experience in data processing prior to working here? (CIRCLE BELOW.)	IF YES TO Q 27 OR 28 29. If you were to hire ___ today, or in the near future, would you give them additional training once they were on the job? (CIRCLE BELOW.)
Key Punchers		YES NO	YES NO	YES NO
Machine Operators		YES NO	YES NO	YES NO
Computer Operators		YES NO	YES NO	YES NO
Programmers		YES NO	YES NO	YES NO
Systems Analysts		YES NO	YES NO	YES NO
Others: 1		YES NO	YES NO	YES NO
2		YES NO	YES NO	YES NO
3		YES NO	YES NO	YES NO

30. If you could obtain personnel easily, would you like to add anything to the requirements you now have?

Yes ____ No ____

IF YES:

Which jobs?	What additional requirements?

31. In general, would you say it is difficult to find qualified personnel for the following jobs: (ASK ONLY ABOUT JOBS IN THIS COMPANY USING LIST AT THE RIGHT.)

32. Would you rank the following in terms of their importance for hiring each of the job classifications which I name: (SHOW CARD 5--USE LIST AT THE RIGHT AND NAME ONLY THOSE JOBS IN THIS COMPANY.)

	QUESTION 31	QUESTION 32		
		General Education	Training in Data Processing	Prior Work Experience but No Formal Training in Data Processing
Key Punchers	Yes No ☐			☐
Machine Operators	Yes No ☐			☐
Computer Operators	Yes No ☐			☐
Programmers	Yes No ☐			☐
Systems Analysts	Yes No ☐			☐
Other: 1	Yes No ☐			☐
2	Yes No ☐			☐
3	Yes No ☐			☐

33. We have already mentioned several types of data processing schools: those run by the manufacturers (e.g., IBM School), business schools, and public schools. Do you think any of these schools do a better job of training then the others?

_____

_____

_____

_____

34. In general, do you think it is important that training in data processing include understanding the equipment and methods of processing well enough so that your employees could help decide how to put information through your equipment. Would you say that this type of training is:
(IF DIFFICULT, SHOW CARD 6 AND CIRCLE LETTER BELOW.)

a. essential

b. helpful

c. doesn't matter

d. a hinderance

35. Suppose two people came to you; they were the same age, same sex and looked equally good; both had limited prior work experience. One had learned to operate a key punch and tabulating equipment in high school, the other person had learned to operate the exact same machine at the IBM School or some other manufacturer, which person would you hire?

High School _____ Manufacturer _____

35a. Why would you hire him? _____

_____

_____

IF COMPUTER INSTALLATION: ASK QUESTION 36:

36. Now with regard to programmers, suppose two people came to you with the exact same qualifications except one had learned to program in high school or college and the other had learned at the IBM School--or some other manufacturer--which person would you hire?

Formal School _____ Manufacturer _____

36a. Could you tell me why you would make that choice? _____

_____

_____

37. Who decides what part of the company operations will be performed on data processing equipment? (Job description.)

_____

_____

38. Is any of your data processing work contracted out to other companies (e.g., IBM Service Bureau)?

IF YES:

38a. About what percent?

_____

38b. Why is it contracted out?

_____

_____

_____

_____

_____

_____

_____

39. I would like to ask you two questions about the future. Do you expect to hire any new _____ (USE LISTING BELOW) within the next two years as replacements or in addition to those you now have?

			IF YES: NUMBER OF REPLACEMENTS		IF YES: NUMBER OF ADDITIONS	
Key Punchers	YES	NO				
Machine Operators	YES	NO				
Computer Operators	YES	NO				
Programmers	YES	NO				
Systems Analysts	YES	NO				
Other:						
1 _____						
2 _____						
3 _____						

40. Do you have any plans to phase out your tabulating or unit record equipment and replace it with computer equipment within the next two years?

Yes _____ No _____

41. Now, I would like to know one last thing. What is the total number of office personnel in this company (AT THIS LOCATION)?

_____
NUMBER

APPENDIX B

REVISED INSTRUMENT

COMPANY NAME _____ INTERVIEW NUMBER _____

	HOW MANY MACHINES DO YOU HAVE IN EACH CLASSIFICATION	HOW MANY MACHINES IN EACH CLASSIFICATION WILL YOU DISCONTINUE IN THE NEXT TWO (2) YEARS	WHICH MACHINES DO YOU HAVE NOW THAT YOU DID NOT HAVE IN 1965 (RECORD NUMBER IN EACH CLASSIFICATION)	WHAT EQUIPMENT DO YOU INTEND TO ADD IN THE NEXT TWO YEARS (ADD ANY EQUIPMENT THAT IS NOT SHOWN)
KEY PUNCH				
VERIFYER				
SORTER				
INTERPRETER				
REPRODUCER				
COLLATOR				
PRINTER (TABULATOR) ACCT'G MACHINE OFF-LINE				
COMPUTER SYSTEM #				
COMPUTER SYSTEM #				
COMPUTER SYSTEM #				
OTHER (UNITS NOT A STANDARD PART OF COMPUTER SYSTEM)				
OTHER				
OTHER				
OTHER				
OTHER				
OTHER				
OTHER				

RECORD THE DATE ON WHICH YOU INSTALLED FIRST SET OF DATA PROCESSING EQUIPMENT _____
DAY, MONTH, YEAR

RECORD THE DATE ON WHICH YOU INSTALLED A COMPUTER _____
DAY, MONTH, YEAR

	1-3	4-24	25-99	100-500	over 500
INDICATE THE TOTAL NUMBER OF EMPLOYEES IN THE COMPANY					
INDICATE THE NUMBER OF DATA PROCESSING EMPLOYEES					

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Interview Number: _____
Company: _____
Address: _____
Telephone Number: _____
Contact: _____
Interviewer: _____

Industry: _____
Respondent's Job Title: _____
If Respondent Different Than Contact:
Name: _____
Report: Yes _____ No _____

Appointment: Date _____ Time _____ AM PM
Time Began: _____ Time Completed: _____
Editing Time: _____

	CALL BACKS	
Date	Time	Explanation

	Col.	Col.2 =3,4,5,6	Col.3	Col.4	Col.5	Col.6	Col.7	Col.8	Col.9	Col.10	Col.11	Col.12	Col.13	Col.14	Col.15	Col.16	Col.17
	HOW MANY EMPLOYEES DO YOU HAVE IN EACH JOB CLASSIFICATION	HOW MANY OF THESE WERE HIRED IN 1965	HOW MANY OF THESE WERE REPLACEMENTS	HOW MANY WERE ADDITIONS	HOW MANY WERE TRANSFERED FROM WITHIN THE COMPANY	(1=H.S. 2=Jr.Col. 3=Degree) INDICATE FOR EACH JOB CLASSIFICATION THE MINIMUM FORMAL EDUCATION YOU REQUIRE	IN WHICH JOB CLASSIFICATION DO YOU REQUIRE PREVIOUS TRAINING	IN WHICH JOB CLASSIFICATION DO YOU REQUIRE EXPERIENCE IN THAT SPECIFIC JOB CLASSIFICATION	RECORD THE MINIMUM ENTRY AGE FOR EACH CLASSIFICATION	RECORD THE MAXIMUM ENTRY AGE FOR EACH CLASSI.	INDICATE THE JOB CLASSIFICATION FOR WHICH YOU PREFER MEN OR WOMEN (MEN=1, WOMEN=2)	DO ANY OF YOUR EMPLOYEES DO WORK OTHER THAN (RECORD CODE NUMBERS) DATA PROCESSING AS PART OF THEIR NORMAL JOB	WHAT SKILLS DO YOU DEMAND BEFORE HIRING FOR EACH JOB CLASSIFICATION (SEE CODE) (RECORD (PUBLIC=1, PRIVATE=2, MANUFACTURER=3)	INDICATE YOUR PREFERENCE FOR HIRING PERSONS FROM DIFFERENT TRAINING SITUATIONS (Code: Very Diff.=1, Diff.=2, No Problem=3)	INDICATE THE DIFFICULTY TO HIRE EMPLOYEES IN EACH JOB CLASSIFICATION (AN ESTIMATE)	RECORD THE APPROXIMATE NUMBER OF PERSONS YOU WILL HIRE IN EACH JOB CLASSIFICATION IN THE NEXT YEAR (AN ESTIMATE)
KEY PUNCH AND VERIFYER OPERATOR																	
MACHINE OPERATORS (CARD)																	
DATA TYPIST																	
TAPE LIBRARIAN																	
CONSOLE OPERATOR & COMPUTER OPERATOR																	
PROGRAMMER I																	
PROGRAMMER II																	
PROGRAMMER III																	
SYSTEMS ANALYST																	
SUPERVISOR																	
MANAGER																	
OTHER																	
OTHER																	
OTHER																	
OTHER																	
OTHER																	

A P P E N D I X C

TABLES

Table I

Employer Requirements for Personnel of a Particular Sex
(In Percents)

Job Title	Male	Female	No Preference
Keypunch	2	52	46
Machine Operator	22	6	72
Computer Operator	15		85
Programmer	10		90
Systems Analyst	7		93
Supervisor	4		96

Note: This table should be read as follows: 2 percent of the employers indicated that they hired only male keypunch employers, etc.

Table II

Employer Preferences for Personnel of a Particular Sex

Jobs For	Percent
Men Only and Women Only	31
Men Only	10
Women Only	27
Either	32

Note: This table should be read as follows: 31 percent of the employers indicated that they had jobs for which they preferred to hire either men or women.

Table III

Employer Requirements of Minimum and/or Maximum Age
(In Percents)

Response	Percent
No Minimum or Maximum	71
Minimum	13
Maximum	1
Yes, Minimum and Maximum	10
No Answer	5

Note: This table should be read as follows: 71 percent of the companies indicated that they had no minimum or maximum age requirements, etc.

Table IV

Reasons Given by Companies Stipulating Minimum Age Requirements

	Key Punch	Machine Operator	Computer Operator	Programmer	Systems Analyst	Supervisor
Company Policy	14	8	10	6	10	6
Want Mature, Responsible People	16	12	6	8	6	-
Military Service	-	2	-	-	2	2
Retirement Benefits	-	2	-	-	-	-
Other	14	12	2	4	2	-

Note: This table should be read as follows: 14 employers indicated that there was a company policy pertaining to the minimum age allowed for hiring key punch operators.